

R E P O R T R E S U M E S

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AN INFORMATION INDEXING, STORAGE, AND RETRIEVAL SYSTEM FOR
DOCUMENTS IN THE FIELD OF INSTRUCTIONAL TECHNOLOGY.

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THIS PRELIMINARY STUDY FOR DEVELOPING A SYSTEM OF
INDEXING MATERIAL ON INSTRUCTIONAL TECHNOLOGY INCLUDED--(1) A
SURVEY AND REVIEW OF THE LITERATURE ON INFORMATION STORAGE
AND RETRIEVAL, (2) AN EXAMINATION OF LOW-COST INFORMATION
STORAGE AND RETRIEVAL SYSTEMS, (3) VISITS TO A NUMBER OF
ORGANIZATIONS AND AGENCIES USING EITHER MANUAL OR MECHANIZED
SYSTEMS RANGING IN COMPLEXITY FROM RELATIVELY INEXPENSIVE
EDGE-NOTCHED CARDS TO EXPENSIVE COMPUTERS, (4) INTERVIEWS
WITH KNOWLEDGEABLE PEOPLE IN THE FIELD, AND (5) THE
DEVELOPMENT OF AN ADEQUATE INDEXING SYSTEM, CHECKED FOR ITS
VALIDITY AND USEFULNESS BY THE STAFF OF THE INSTRUCTIONAL
TECHNOLOGY AND MEDIA PROJECT AND BY MANY OTHERS IN THE FIELD.
RECOMMENDATIONS FOR AN EQUAL-TERM INDEX AND ADDITIONAL
PERSONNEL ON THE INDEXING STAFF HAD ALREADY BEEN IMPLEMENTED.
OTHER RECOMMENDATIONS WERE TO BE IMPLEMENTED IN THE NEAR
FUTURE. (JC)

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June 1964

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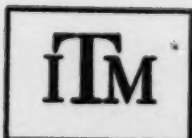
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AN INFORMATION INDEXING, STORAGE, AND RETRIEVAL
SYSTEM FOR DOCUMENTS IN THE FIELD OF
INSTRUCTIONAL TECHNOLOGY

DEVELOPING THE INFORMATION STORAGE
AND RETRIEVAL SYSTEM

Background

In the fall of 1960, the Educational Media Branch of the U. S. Office of Education entered into a contract with the National Education Association for an overall assessment of the nature and impact upon teaching and the teaching profession of the much discussed technological revolution in education. The project was known as the Technological Development Project (TDP); headquarters were located in the School of Education, University of Southern California, and the director was James D. Finn, Professor of Education. A second office for the Project was maintained in the National Education Association in Washington. The Project lasted from October, 1960 to February, 1963.

The principal task of the Technological Development Project was essentially one of synthesis and prediction. An attempt was made to make some kind of overall sense out of the mounting developments, knowledge, and speculation in instructional technology; to forecast what reasonably might be expected to occur in the next few years in education; and to set up some guidelines for the profession to use in dealing with the accelerating changes of the future. Information was gathered and synthesized from existing studies, surveys, and experiments as well as by original studies, observations, and interviews. Project findings were disseminated by a series of

ten occasional papers, three monographs, a series of articles in various professional journals, and several audio-visual presentations.

The Educational Media Branch of the U. S. Office of Education was interested in continuing certain aspects of the Technological Development Project and in initiating certain other operations in order to communicate more usable information about instructional technology to the educational profession. The result of this thinking led to the creation of the current Instructional Technology and Media (ITM) Project under a contract with the University of Southern California. The two-year ITM Project builds upon the work of the Technological Development Project and has three missions: (1) the procurement of a series of ten monograph manuscripts for the U. S. Office of Education synthesizing research findings in the new media field; (2) the production of several motion pictures on the role of the new media in education; and (3) the continuation (from the old TDP) of the monitoring, assessment and predictive functions relating to technological developments in education.

It is the third mission of the ITM Project--the monitoring, assessment, and predictive functions--with which this paper is mainly concerned; for essential to these functions is the immediate availability of fugitive and unusual materials collected on technological developments relating to education. Therefore, as a part of the operation an adequate information storage system which would permit rapid retrieval of documents and other materials is to be developed.

During the two-plus years the Technological Development Project was in operation, the possibilities for developing a

documentation center, which would store and locate research and other materials in the field of instructional technology, were explored. Initially, this began with a need to develop an information storage and retrieval system to handle the large numbers of materials the Project was accumulating. A good-sized collection of documents--research studies, reports, out-of-the-way articles--covering the whole field of instructional technology from television and teaching machines to computers and information display systems, from psychological laboratory studies of media behavior to large field studies, had been gathered. In addition, substantial collections of photographs, slides, and commercial literature were developed. In order to make these materials available to the searcher or user, an edge-notched card system utilizing needle-sort techniques was established. However, because of a lack of both professional and clerical personnel and of a definitive index of terms, the system was less than adequate. Materials could not be cataloged at the same pace at which they were acquired, resulting in an ever-growing backlog of documents. Documents could not be classified in such a way as to provide proper and rapid retrieval, due to the limitations of the index. In the meantime, the collection increased.

When the ITM Project was under consideration, the experience of the Technological Development Project with the information problem was evaluated. The collection at this time was approaching 2,500 documents and an undetermined number of slides and photographs.

The problem then became one of studying the information

situation of the Project with the objectives of (1) developing an adequate system of indexing covering the field of instructional technology as viewed within the frame of reference of the staff, (2) selecting a technology to handle the information which would fit the needs of the staff and which would utilize the new indexing system, and (3) surveying possible additional uses of the system by the Educational Media Branch of the U. S. Office of Education, and the Department of Audiovisual Instruction of the National Education Association, as both of these agencies have a stake in the information development undertaken by the Project.

Preliminary Study

A preliminary study was conducted which included the following: (1) a survey and review of the literature on information storage and retrieval, (2) an examination of low-cost information storage and retrieval systems, (3) visits to a number of organizations and agencies throughout the country which were using either manual or mechanized systems ranging in complexity from relatively inexpensive edge-notched cards to expensive computers, (4) interviews with knowledgeable people in the field, and (5) the development of an adequate indexing system, checked for its validity and usefulness by the staff of the ITM Project and by many knowledgeable people in the field.

In the consideration of any rapid retrieval system, there are several basic questions which should be answered at the very outset:

1. Should the system provide just the serial numbers or "addresses" of the documents, with consequent retrieval

of the actual documents?

2. Should the system provide an abstract of the document on microfilm for immediate viewing or in hard copy form for the user to take with him?
3. Will the system be operated by the user (or searcher) or will a librarian, literature searcher, or documentalist locate and retrieve the information or documents for him?

The answers to these questions will determine for the most part the type of system used, the complexity of the "hardware," and the depth of the indexing.

In developing an adequate index of terms for classifying the documents and other materials acquired by the Project, consideration was given to three widely-used types of indexing systems--classification, subject catalog, and keyword. Classification systems, such as Library of Congress and Dewey Decimal, are hierarchical and permit the user to find the generic category and to proceed from there. Also, since hierarchical systems proceed from the generic to the specific, they usually can provide more complete retrieval, more easily and quickly, than other systems. On the other hand subject catalog systems arrange information under alphabetical lists of subject headings, such as you will find in the library or in a book index. Keyword systems, in contrast to the other two, utilize descriptive words or phrases as index keys. Several approaches to indexing, similar to the keyword system, were considered in the development of the Project's indexing system. These will be discussed in that section of this paper.

Five recommendations stemmed from the preliminary study.

Those recommendations are as follows:

1. The adoption of the index (included in this paper) as an equal-term index and one which would permit the addition of terms as needed.
2. The adoption of the so-called "peek-a-boo" system for information retrieval.
3. Personnel should be added due to the increase in the collection, the size of the indexing workload, and the relative shortness of time.
4. The information system should be made available to both the Educational Media Branch of the U. S. Office of Education and the Department of Audiovisual Instruction of the National Education Association by the provision of appropriate equipment. Other agencies should be added only upon approval of the Project Advisory Staff and the Educational Media Branch.
5. The collection of documents and the information system should be established in such a way that they can remain at the University of Southern California at the conclusion of the Project.

Recommendations No. 1 and No. 3 above have already been implemented; recommendations No. 2 and No. 4 will be put into effect shortly; and recommendation No. 5 will be fulfilled in the future plans of the Project.

Information System Technology

As mentioned earlier, the ITM Project has been using an edge-notched card system for retrieval of documents by subjects or categories. In this system there is one card for each item stored in the system. Each card is punched or notched in various ways to permit retrieval from several points of view. Retrieval is accomplished by inserting a "needle-like" tool into the appropriate hole to drop out the cards listing the documents pertinent to the search question. This has sometimes been referred to as "selection by rejection."

However, entering information on these cards and later retrieving it can be quite time-consuming and a rather cumbersome activity at times. As the collection grows, rapid retrieval becomes increasingly more difficult, as only about 300-400 of these cards can be finely sorted by the needle at a time.

With the desire to provide a more efficient and usable information storage and retrieval system, the ITM Project will be establishing a "peek-a-boo" system as recommended in the preliminary study. The "peek-a-boo" type of system (also referred to as "super-imposable," "peephole," or "feature card") is based upon the peek-a-boo technique which is the mechanism for identifying documents having a number of characteristics, concepts, or aspects in common. It offers a number of advantages over the present system, as far as Project needs are concerned, and should provide for more rapid retrieval of stored documents and other materials.

In the "peek-a-boo" system a card is provided for each term or descriptor used to describe the information in a document, rather than a card for each document. The field of the type of card under

consideration contains 10,000 positions which are identified by rectangular coordinates. Each of the positions corresponds to an item number. In this way, a collection of 10,000 items could be stored on a few hundred cards (depending of course, upon the number of terms in the thesaurus or index.)

For each document all term cards, which describe the information contained therein, are selected and a hole is punched in the position corresponding to the document number. Each card then has a hole for each document described by that term. Retrieval is accomplished by superimposing the term cards, dictated by the search question, on a card reader--or in front of any light source. The position numbers indicated by the spots of light--from light shining through the holes--are the numbers of the documents containing information in answer to the search question. In other words, the system provides the "addresses" only; the actual document, or its abstract, will then have to be retrieved from the files.

We realize that any information system which just provides the "addresses" of the documents is only doing part of its job. However, this is a necessary first step in our program to meet user needs. Providing the user with a list of pertinent document numbers which he can use for later retrieval purposes, or retrieving the actual documents for him (if he requests it) is all that is required of the Project's information system at the present stage of its development. Later on, as funds permit and as user demands become greater and more varied, more "sophisticated" retrieval methods will be employed. These will be described in Plans for the Future.

Once the system is operating, keeping it up to date is rapid

and simple. As each new document is entered, all of the appropriate term cards are drilled by a single drilling motion. That document is then in the system, ready to be searched.

Project plans call for duplicate sets of these cards in order to make the collection of documents available to both the Educational Media Branch and the Department of Audiovisual Instruction. Each of these "user groups" would be provided with a complete set or deck of cards, when the Project's new system is established. Then, every sixty days an up-to-date deck of cards would be shipped to these two groups. This updated deck would then replace the "outdated" cards, which would be returned immediately to the Project office at the University of Southern California for updating. In this way the two "systems" in Washington, D. C., can be kept reasonably current. If faster service is required at any time, the updating procedure could be accelerated, or the most current deck of cards could be shipped immediately upon receiving a telephone request from either of the two groups--the Educational Media Branch or the Department of Audiovisual Instruction.

The advantages of this type of information system are that it is user-oriented, simple to use, easy to keep current, economical to operate, and has almost unlimited flexibility. It can serve a collection of many thousands of documents as well as one having only a few thousand items, and it can expand to meet future needs. Utilizing microfilm versions of this system, it would be possible to handle collections up to one million items. Actually, the true potential of the "peek-a-boo" technique is yet to be realized. Much more needs to be done in studying and experimenting with "peek-a-boo" systems to

discover the many possible applications of this technique.

DEVELOPING A THESAURUS OR INDEXING SYSTEM

The versatility and effectiveness of any information storage and retrieval system are directly related to the definitiveness and usefulness of the thesaurus or index of terms. Accurate and rapid retrieval of information is greatly dependent upon a good indexing system for the classification of documents or parts of documents.

Technology is available today to establish and expand any information system to meet all kinds of user needs; the problem, of course, lies in the proper utilization of this technology. No device, simple or complex, can compensate for poor analysis of information and inadequate use of terminology; no amount of mechanization will retrieve anything which has not been indexed correctly.

The research and literature in the information science field emphasize the importance of a meaningful, well-developed index of terms, stating, in effect, that the indexing thesaurus should be authoritative, but still provide for evolutionary changes and for extensive cross-referencing among synonyms.

In developing an index or thesaurus (which has been defined as a compilation of sets of words with extensive cross-referencing between the sets), a number of factors should be considered. Some of these are specificity of terms, hierarchical versus alphabetical classification, number of practical levels, selection and accumulation of terms, and the development of relationships. However, in our opinion, the first and most important consideration should be the "user" of the system; for a system exists to serve the needs of its

users. The success of any information system is measured principally in terms of user satisfaction. A system may operate efficiently, effectively, rapidly, and economically; but, if it cannot meet the needs of its users, it might as well cease to exist. Therefore, the terms used to index and classify the documents and other materials entered into the system should be familiar to the user (or searcher), and they should be terms which he would use in seeking information or in retrieving documents from the files.

In establishing the index of terms for the ITM Project, besides examining the principal types of indexing, several approaches were considered, including Uniterms and Descriptors. Uniterms, a system developed by Mortimer Taube, are the significant terms, or keywords, in a document. If a document contained seven uniterms, for example, it would be indexed under each of the seven, with each Uniterm having its own file card. Descriptors, a system developed by Calvin Mooers, are derived by analyzing a number of related documents and drawing up a list of key terms--terms which broadly cover the particular subject. However, neither of these seemed to be the type of indexing system which would satisfy the unique requirements of the Project's information system. Finally, it was decided that a list of categories, covering the entire field of instructional technology, as viewed within the frame of reference of the staff, would be the most adequate system of indexing for our purposes. These categories, being familiar to both the indexer and the user, would facilitate both the classification and retrieval of documents.

Twenty-nine major categories or areas were selected, and these were broken down into a number of subdivisions (for a total of 319

categories). This would allow the user of the system to be as generic or specific as he wished in his search. Although these indexing categories are listed in hierarchical fashion, each would carry equal weight in the classification of documents. This would permit the indexer to classify each document by as many of these categories as he considers necessary to provide for the different points of view from which the information on the document might be retrieved. To facilitate the user's task of searching for information, this index has also been prepared in alphabetical arrangement, with appropriate cross-referencing of synonyms. The complete indexing system is designed with built-in flexibility to permit the addition or deletion of terms at any time, and it is a system which can be used with various kinds of "hardware" including edge-notched, "peek-a-boo," and punched cards.

PLANS FOR THE FUTURE

Our first hope is to expand the present service--which provides document addresses or file numbers only--to all interested scholars. With the approval of the Project Advisory Staff and the Educational Media Branch, we intend to investigate increasing the number of users of the system. It is our desire, if possible, to make this service available to any individual or group having a need for information in the areas covered by our index of terms. Then, as more use is made of the information system, as more scholars avail themselves of this service, and as requests are received for the physical documents themselves, consideration will need to be given to extending the present service.

If the document or its abstract is to be retrieved from the files, several approaches could be utilized. For example, through the addition of a microfilm reader-printer (such as Recordak or Thermo-fax) and a keypunch to the system, the user or searcher may immediately view an abstract of the document by the simple operation of "punching" or "typing" in the address. If desired, each document page could be placed on microfilm. Then when the "address" is typed on the keypunch, the first page of the document would appear; and by pressing an advance key, each succeeding page could be viewed. In addition, a print-out of the abstract (or page) of the document would be immediately available to the user. Providing "hard" copies of the abstracts or documents would be a necessary step if the user were not able to perform the search himself. Many scholars utilizing this service from distant locales would want to see the actual document or its abstract. Sending a print-out of the abstract (or of the entire document) may be the most desirable method since, in most cases, the actual document will need to remain in the system.

Future plans of the ITM Project's information system call for the addition of a reader-printer, when funds permit and when user demands warrant it. When the microfilm feature is added, there is no limit to the expansibility of the system.

Other new microfilm retrieval systems being considered for possible use in the future are the MIRACODE, a rapid system which can retrieve any one of more than 900,000 pages of information in less than fifteen seconds, according to Recordak, developers of the system; the Filmsort Aperture Card System, developed by the Minnesota Mining and Manufacturing Company, which combines microfilm efficiency with

data processing speed; Media, a new system which stores numbered documents on tiny "chips" of microfilm; and Microfiche, which consists of short strips of microfilm. This latter product, Microfiche, would be a useful way of distributing abstract bulletins. It has a number of advantages, including the following: (1) it can be interfiled with existing records, (2) one 5 x 3 inch sheet has sufficient capacity for most scientific documents, (3) prints and enlargements can be made quickly and economically, and (4) the Microfiche need not be returned to the originating information system.

MIRACODE, which stands for Microfilm Information Retrieval Access CODE, is a system designed for collections where it is desirable to locate documents by their subject content or by their file numbers (or "addresses"). Therefore, the adoption of this type of system, which features rapid document image access, paper printout, and the versatility of film file-browsing, would be a natural extension of the "peek-a-boo" system to provide an even greater service to the user.

Still other considerations, with possible future applications for the Project's information system, are the Microcite System of the National Bureau of Standards and the Photochromic Micro-Image (PCMI) technique for storage and dissemination of microdocuments, developed by the National Cash Register Company. The Microcite machine employs the "peek-a-boo" technique and presently stores 18,000 images of document abstracts on a 15 x 15 inch film sheet, although it has the capability of storing millions of images. When the illuminated holes in a selected set of "peek-a-boo" cards are intersected by the rectangular coordinates, the appropriate image is positioned for

projecting. Instead of reading the serial numbers as in the conventional "peek-a-boo" system, the user views directly at each hole position an abstract (on microfilm) of the document. With the Microcite machine the user may perform the search himself. He is at all times in control of the search process and is immediately informed of the nature of the information being discovered.

The PCMI technique is one of the most promising developments in miniaturization. The best that can be expected from microfilm is an area reduction of about 900 to 1; but photochromic micro-images, by contrast, can be reduced to 40,000 to 1. With this 40,000 to 1 reduction in area, a 400-page book can be printed in a square inch. Also, it would be possible to have an entire library collection compressed to card-file size for rapid reproduction and dissemination.

These are some of the newer developments in the field of information storage and retrieval which we are considering as we look for better ways of storing and retrieving the ever-growing body of information in the instructional technology field. We would like to hear from scholars who are interested in the development of our information system. We are always open to suggestions and recommendations for improving the Project's information system and the services provided its users. Please address all correspondence to:

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Today the trend seems to be toward decentralization of information or documentation centers, with various institutions collecting

in depth in their specific areas (historically as well as currently) and with one central agency to tell the searchers "where to find it." In light of this apparent trend, it is hoped that the present information system will develop into an international documentation center for the growing field of educational technology.

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Today the trend seems to be toward decentralization of labor-
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INSTRUCTIONAL TECHNOLOGY AND MEDIA PROJECT

Documentation Center

INDEX OF TERMS

General Areas Covered by the System to Date

1. Administration
2. Curriculum
3. Communication Theory
4. Educational Environment
5. Equipment
6. Economics - Educational Productivity
7. Science, General
8. History, Philosophy, General Educational Theory
9. Instructional Systems
10. Military Development
11. Social Factors Influencing Education
12. Learning - Psychology
13. Mass Media
15. Media, General
16. Media Production and Production Design
17. International Applications of Technology
18. Miscellaneous
19. Professional Education
20. Studies in Progress
21. Research and Development, General
22. Staff Utilization

23. Technology, General
24. Utilization of Information and Data Processing Systems
25. Copyrights, Patents, etc.
26. New Industrial Developments
27. Bibliographies
28. Innovation
29. Related Disciplines

NOTE: Although the following indexing terms are in partial outline form, they will have equal weight in the classification of documents. The outline form is being used merely to facilitate the understanding and the usage of the terms.

1. ADMINISTRATION

- 1.1 General administration, media
- 1.2 Role of administrators in educational innovation

2. CURRICULUM

- 2.1 New developments in courses of study, etc.
- 2.2 General

3. COMMUNICATION THEORY

- 3.1 General
- 3.2 Models
- 3.3 Non-Verbal

4. EDUCATIONAL ENVIRONMENT

- 4.1 Overall building and planning
- 4.2 Classroom
- 4.3 Library
- 4.4 Instructional materials center
- 4.5 Auditorium

5. EQUIPMENT

5.1 Conventional audio-visual (to 1955)

- 5.1.1 Film
- 5.1.2 Filmstrip
- 5.1.3 Slide
- 5.1.4 Opaque
- 5.1.5 Overhead
- 5.1.6 Record players
- 5.1.7 Tape recorders
- 5.1.8 Radio
- 5.1.9 Maps and globes
- 5.1.10 Models and kits

5.2 Transition period (to 1965)

- 5.2.1 Language laboratories
- 5.2.2 Television
- 5.2.3 Teaching machines and programmed learning
- 5.2.4 Random access equipment
- 5.2.5 Performance aid
- 5.2.6 Copy systems
- 5.2.7 Videotape recorders, etc.

5.3 Current and new

- 5.3.1 8mm
- 5.3.2 Multiple screen projection (random access)
- 5.3.3 Classroom communicators
- 5.3.4 Computers
 - 5.3.4.1 General
 - 5.3.4.2 As teaching machines
 - 5.3.4.3 Programing for computers
- 5.3.5 Test-scoring equipment
- 5.3.6 Simulators
- 5.3.7 Facsimile
- 5.3.8 Microfilm readers

5.4 Technological developments (beyond 1965)

- 5.4.1 Information systems
 - 5.4.1.1 Processing of information
 - 5.4.1.2 Storage and retrieval of information
 - 5.4.1.3 Transmission and display of information
- 5.4.2 Computer advances
- 5.4.3 Translating machines
- 5.4.4 Educational data-processing
- 5.4.5 Artificial intelligence
- 5.4.6 Other

6. ECONOMICS - EDUCATIONAL PRODUCTIVITY

- 6.1 Costs
- 6.2 Resources and ability to pay
- 6.3 Productivity
- 6.4 Needs
- 6.5 Budgets
- 6.6 General

7. SCIENCE, GENERAL

8. HISTORY, PHILOSOPHY, GENERAL EDUCATION THEORY

- 8.1 History
- 8.2 Philosophy
- 8.3 General educational theory (includes educational objectives)

9. INSTRUCTIONAL SYSTEMS

- 9.1 Logistics
- 9.2 Theory
- 9.3 Historical background
- 9.4 Development

10. MILITARY DEVELOPMENTS

11. SOCIAL FACTORS INFLUENCING EDUCATION

- 11.1 Population
- 11.2 Knowledge
- 11.3 Innovation
- 11.4 Technology (automation, etc., on education, specifically)
- 11.5 General

12. LEARNING - PSYCHOLOGY

- 12.1 Learning objectives
 - 12.1.1 Conceptual
 - 12.1.2 Factual
 - 12.1.3 Attitudinal
 - 12.1.4 Motor skills
- 12.2 Learning theory
- 12.3 Learning processes
- 12.4 Motivational factors in learning
- 12.5 Methodology (applied educational psychology)
- 12.6 Individual differences
- 12.7 Experimental analysis of learning factors
- 12.8 Learning theory and educational media
- 12.9 Environmental influence
- 12.10 Physiological psychology
- 12.11 Perception

13. MASS MEDIA

14. MEDIA, GENERAL

- 14.1 Language (learning) laboratories
- 14.2 Television
 - 14.2.1 Broadcast
 - 14.2.2 Closed-circuit
 - 14.2.3 Airborne
 - 14.2.4 Commercial
- 14.3 Teaching machines and programed learning
 - 14.3.1 Books, notebooks, etc.
 - 14.3.2 Teaching machines
 - 14.3.2.1 With sound
 - 14.3.2.2 Incorporating projection
 - 14.3.2.3 With random access

- 14.3.3 Self-instructional equipment other than teaching machines
 - 14.3.3.1 Reading pacers
 - 14.3.3.2 Viewers
 - 14.3.3.3 Listening centers
- 14.4 8mm projection
- 14.5 Multiple-screen projection
 - 14.5.1 Random access
 - 14.5.2 Rear projection
 - 14.5.3 Front projection
- 14.6 Computers
 - 14.6.1 General
 - 14.6.2 As teaching machines
- 14.7 Films
 - 14.7.1 16mm sound film
 - 14.7.2 8mm sound film
 - 14.7.3 Film packages
 - 14.7.4 Film and tape courses
 - 14.7.5 Silent film
- 14.8 Filmstrips
- 14.9 Slides
- 14.10 Photographs and still pictures
- 14.11 Maps, globes, charts
- 14.12 Models, displays, exhibits
- 14.13 Microfilm
- 14.14 Opaque projection
- 14.15 Overhead projection
- 14.16 Recordings
 - 14.16.1 Records
 - 14.16.2 Tapes
 - 14.16.3 Kinescope and videotape
- 14.17 Radio
- 14.18 Audiovisual kits
- 14.19 Cross-media or multi-media approach
 - 14.19.1 Instructional systems
 - 14.19.2 Simulators
- 14.20 Classroom communicators

15. MEDIA RESEARCH

15.1 Language (learning) laboratories

- 15.1.1 Comparative effectiveness
- 15.1.2 Audience characteristics
- 15.1.3 Physical conditions of use
- 15.1.4 Educational objectives
- 15.1.5 Techniques of use
- 15.1.6 Production variables
- 15.1.7 Statistics
- 15.1.8 Other

15.2 Television

- 15.2.1 Comparative effectiveness
- 15.2.2 Audience characteristics
- 15.2.3 Physical conditions of use
- 15.2.4 Educational objectives
- 15.2.5 Techniques of use
- 15.2.6 Production variables
- 15.2.7 Statistics
- 15.2.8 Other

15.3 Teaching machines and programmed instruction

- 15.3.1 Comparative effectiveness
- 15.3.2 Audience characteristics
- 15.3.3 Physical conditions of use
- 15.3.4 Educational objectives
- 15.3.5 Techniques of use
- 15.3.6 Production variables
- 15.3.7 Statistics
- 15.3.8 Other

15.4 Films

- 15.4.1 Comparative effectiveness
- 15.4.2 Audience characteristics
- 15.4.3 Physical conditions of use
- 15.4.4 Educational objectives
- 15.4.5 Techniques of use
- 15.4.6 Production variables
- 15.4.7 Statistics
- 15.4.8 Other

15.5 Still graphics

- 15.5.1 Comparative effectiveness
- 15.5.2 Audience characteristics
- 15.5.3 Physical conditions of use
- 15.5.4 Educational objectives
- 15.5.5 Techniques of use
- 15.5.6 Production variables
- 15.5.7 Statistics
- 15.5.8 Other

15.6 Non-projected graphics

- 15.6.1 Comparative effectiveness
- 15.6.2 Audience characteristics
- 15.6.3 Physical conditions of use
- 15.6.4 Educational objectives
- 15.6.5 Techniques of use
- 15.6.6 Production variables
- 15.6.7 Statistics
- 15.6.8 Other

15.7 Printed materials

- 15.7.1 Comparative effectiveness
- 15.7.2 Audience characteristics
- 15.7.3 Physical conditions of use
- 15.7.4 Educational objectives
- 15.7.5 Techniques of use
- 15.7.6 Production variables
- 15.7.7 Statistics
- 15.7.8 Other

15.8 Audio-recorded

- 15.8.1 Comparative effectiveness
- 15.8.2 Audience characteristics
- 15.8.3 Physical conditions of use
- 15.8.4 Educational objectives
- 15.8.5 Techniques of use
- 15.8.6 Production variables
- 15.8.7 Statistics
- 15.8.8 Other

15.9 Multi-media or cross-media approach

- 15.9.1 Comparative effectiveness
- 15.9.2 Audience characteristics
- 15.9.3 Physical conditions of use
- 15.9.4 Educational objectives
- 15.9.5 Techniques of use
- 15.9.6 Production variables
- 15.9.7 Statistics
- 15.9.8 Other

15.10 Multiple screen projection

- 15.10.1 Comparative effectiveness
- 15.10.2 Audience characteristics
- 15.10.3 Physical conditions of use
- 15.10.4 Educational objectives
- 15.10.5 Techniques of use
- 15.10.6 Production variables
- 15.10.7 Statistics
- 15.10.8 Other

15.11 Computers

- 15.11.1 Comparative effectiveness
- 15.11.2 Audience characteristics
- 15.11.3 Physical conditions of use
- 15.11.4 Educational objectives
- 15.11.5 Techniques of use
- 15.11.6 Production variables
- 15.11.7 Statistics
- 15.11.8 Other

15.12 8mm projection

- 15.12.1 Comparative effectiveness
- 15.12.2 Audience characteristics
- 15.12.3 Physical conditions of use
- 15.12.4 Educational objectives
- 15.12.5 Techniques of use
- 15.12.6 Production variables
- 15.12.7 Statistics
- 15.12.8 Other

15.13 Methodological problems

15.14 Status and criticism

16. MEDIA PRODUCTION AND PRODUCTION DESIGN

- 16.1 Films
- 16.2 Still graphics
- 16.3 Non-projected graphics
- 16.4 Audio-recorded
- 16.5 Printed materials
- 16.6 Programed instruction
- 16.7 Three-dimensional
- 16.8 Multi-media
- 16.9 Computers
- 16.10 Instructional systems

17. INTERNATIONAL APPLICATIONS OF TECHNOLOGY

- 17.1 General (economic development, etc.)
- 17.2 Educational

18. MISCELLANEOUS

- 18.1 AV presentation scripts
- 18.2 Speeches
- 18.3 Conference programs
- 18.4 Registration information
- 18.5 Surveys and questionnaires
- 18.6 Book reviews
- 18.7 Personnel directories
- 18.8 Catalogs

- 18.8.1 Equipment
- 18.8.2 Materials

- 18.9 Professional associations and organizations
- 18.10 Other

19. PROFESSIONAL EDUCATION

- 19.1 Teachers
- 19.2 Specialists
- 19.3 Administrators

20. STUDIES IN PROGRESS

- 20.1 ITM studies
- 20.2 Other studies

21. RESEARCH AND DEVELOPMENT, GENERAL

- 21.1 General
- 21.2 Administration
- 21.3 Economics
- 21.4 Social effects
- 21.5 Education
- 21.6 Dissemination of R and D information
- 21.7 Foundations (Ford, Carnegie, Rockefeller)
- 21.8 Public funds (military, NDEA, other government funds)
- 21.9 Organizations

22. STAFF UTILIZATION

- 22.1 Classroom design
- 22.2 Flexible scheduling
- 22.3 Grouping for instruction
- 22.4 Staff patterns
- 22.5 Team teaching

23. TECHNOLOGY, GENERAL

- 23.1 General
- 23.2 Educational effects
- 23.3 Effects of automation on society
- 23.4 Adult education
 - 23.4.1 Manpower Development and Training Act of 1962
 - 23.4.2 Reeducation
 - 23.4.3 Job training
 - 23.4.4 General

24. UTILIZATION OF INFORMATION AND DATA PROCESSING SYSTEMS

25. COPYRIGHTS, PATENTS, ETC.

26. NEW INDUSTRIAL DEVELOPMENTS

- 26.1 Optical
- 26.2 Electronic
- 26.3 Mechanical
- 26.4 Organizational
- 26.5 Miscellaneous

27. BIBLIOGRAPHIES

28. INNOVATION

- 28.1 Attitudes
- 28.2 Information flow
- 28.3 Criticism
- 28.4 Legislation

29. RELATED DISCIPLINES

- 29.1 Interdisciplinary approach
- 29.2 Design and art theory
- 29.3 Cultural anthropology
- 29.4 Psycho-linguistics
- 29.5 Aesthetics
- 29.6 Semantics, logical analysis, etc.
- 29.7 Social psychology
- 29.8 Other